

AD-A093 738

ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMM--ETC F/0 13/6
VERIFICATION TEST OF JET INDUSTRIES ELECTRA-VAN 1000P, (U)

OCT 80 E J DOWDIALLO, I R SNELLINGS

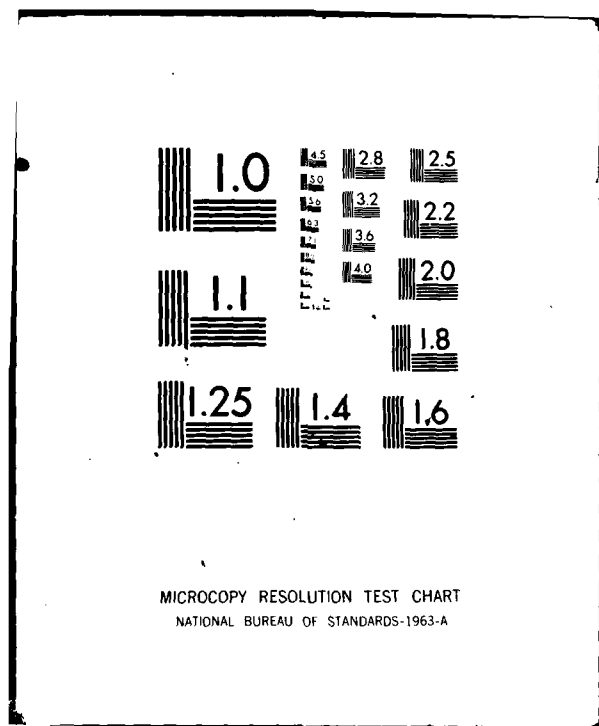
EC-77-A-31-1042

UNCLASSIFIED

NERADCOM-2311

[OP]
AD-A093 738

END
DATE
FILMED
12-84
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

12

AD

Report 2311

LEVEL II

VERIFICATION TEST OF JET INDUSTRIES ELECTRA-VAN 1000P

by

Edward J. Dowgiallo, Jr.

Ivan R. Snellings

and

William H. Blake

DTIC
ELECTE
JAN 14 1981
S
E

October 1980

Approved for public release; distribution unlimited.

**U.S. ARMY MOBILITY EQUIPMENT
RESEARCH AND DEVELOPMENT COMMAND
FORT BELVOIR, VIRGINIA**

81 1 13 002

AD A093738



DDC FILE



**Destroy this report when it is no longer needed.
Do not return it to the originator.**

**The citation in this report of trade names of commercially
available products does not constitute official endorsement
or approval of the use of such products.**

UNCLASSIFIED

14

MERADCOM-2311

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 2311	2. GOVT ACCESSION NO. AD A093738	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) 6 VERIFICATION TEST OF JET INDUSTRIES ELECTRA-VAN 1000P		5. TYPE OF REPORT & PERIOD COVERED Verification Test 11 Oct to 29 Oct 79
7. AUTHOR(s) 10 Edward J. Dowgiallo, Jr. Ivan R. Snellings William H. Blake		6. PERFORMING ORG. REPORT NUMBER
8. PERFORMING ORGANIZATION NAME AND ADDRESS Electrochem Div; Elec Pwr Lab; DRDME-EC; US Army Mobility Equipment Research & Development Com Fort Belvoir, Virginia 22060		8. CONTRACT OR GRANT NUMBER(s) 15 Interagency Agreement EC-77-A-31-1042
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Mobility Equipment Research & Development Com ATTN: DRDME-EC Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 11
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Prepared for Dept of Energy; Assistant Secretary for Conservation and Solar Energy; Division of Electric and Hybrid Vehicles 12 31		12. REPORT DATE October 1980
		13. NUMBER OF PAGES 33
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electric Vehicle Propulsion Batteries Charger		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Jet Industries Electra-Van 1000P is a Chrysler Corp. pickup truck which has been converted to an electric vehicle. It was tested by MERADCOM as part of a Department of Energy demonstration program. The Electra-Van 1000P performance test results are presented. The 1000P is powered by 24 6-volt lead acid batteries through an SCR Controller to a 37-hp electric motor. It has a manual 4-speed transmission and front disc and rear drum brakes. It does not have regenerative braking.		

DD FORM 1473
1 JAN 73

EDITION OF 1 NOV 65 IS OBSOLETE

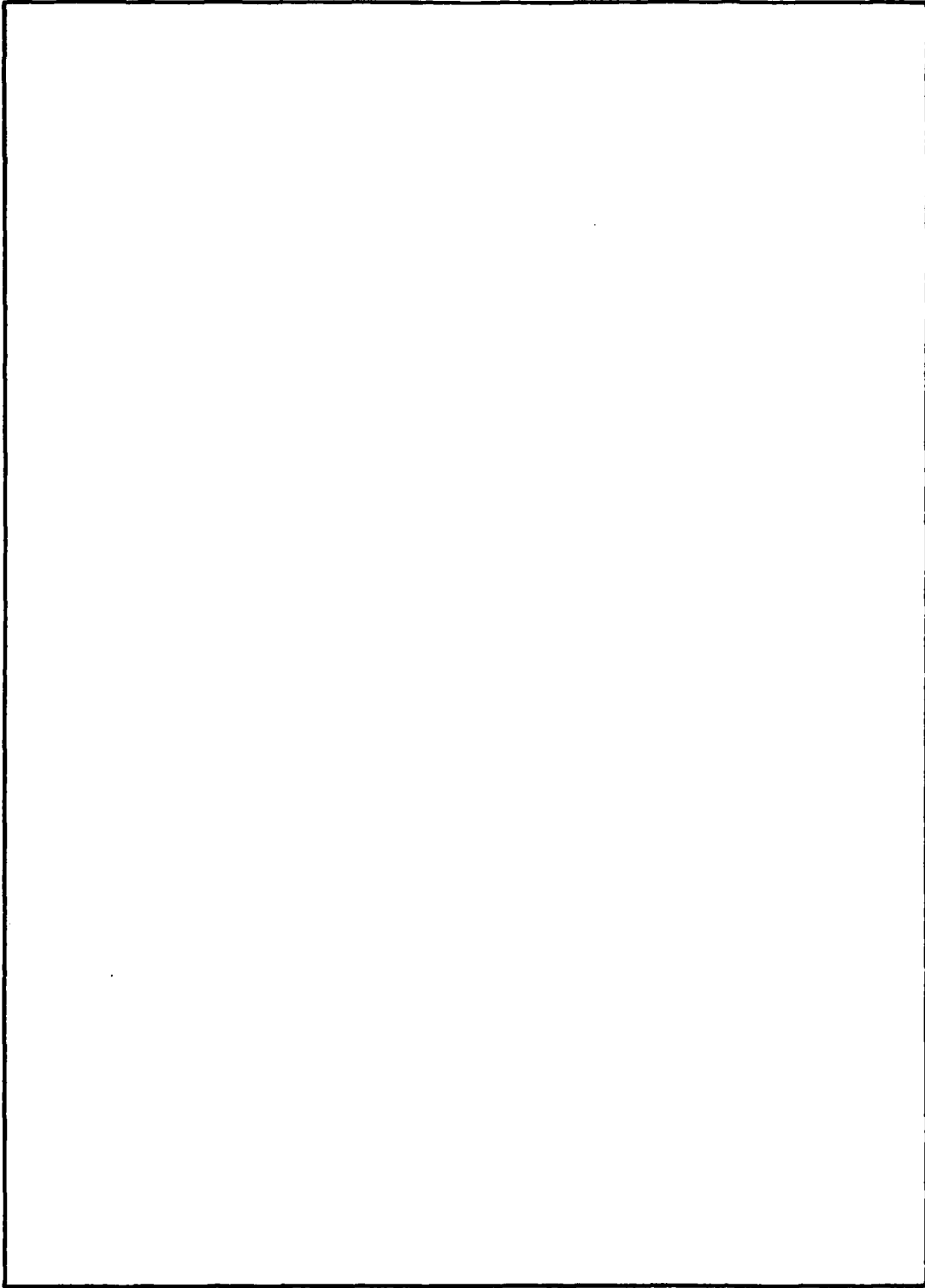
UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

403160

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)



UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

CONTENTS

Section	Title	Page
	ILLUSTRATIONS	iv
II	SUMMARY	1
III	OBJECTIVES	1
IV	VEHICLE TEST DESCRIPTION	2
V	TEST RESULTS	2
VI	CHRONOLOGY OF VEHICLE FAILURES AND CORRECTIVE ACTIONS	7
	APPENDICES	
A.	VEHICLE DATA SUMMARY SHEET	8
B.	PERFORMANCE STANDARDS FOR DEMONSTRATIONS	12
C	ELECTRIC AND HYBRID VEHICLE VERIFICATION PROCEDURES	15

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

ILLUSTRATIONS

Figures	Title	Page
1	Front/Side View of Electra-Van 1000P	3
2	Rear/Side View of Electra-Van 1000P	3
3	Front of Vehicle Showing Traction Batteries and Auxiliary Battery	4
4	Cargo Area Showing Rear Traction Batteries	4
5	Controller and Associated Electronics	5

VERIFICATION TEST OF JET INDUSTRIES ELECTRA-VAN 1000P

I. SUMMARY

The Electra-Van 1000P manufactured by Jet Industries, Inc., Austin, Texas, was tested during the period from 11 October to 29 October 1979. Complete test results are contained in Section V. Part of the verification test results are summarized below:

Acceleration:	50 km/h (31.1 mi/h) in 12.5 s.
Range:	59.4 km (36.9 mi), 169 cycles of SAE J227a schedule B driving cycle.
Forward Speed Capability:	70 km/h (43.5 mi/h) was maintained for more than 5 min.
Gradeability at Speed:	At 25 km/h (15.5 mi/h) can traverse a 13.2-percent grade.
Gradeability Limit:	27-percent forward gradeability for at least 20 s, and a calculated 28.1-percent reverse gradeability limit.

II. INTRODUCTION

The Electra-Van 1000P electric vehicle was operated to determine conformity to the Department of Energy Performance Standards for Demonstrations, published in the *Federal Register*, 30 May 1978, Part V. The results of that testing, as performed by the US Army Mobility Equipment Research and Development Command (MERADCOM), as well as other descriptive data concerning the vehicle, are presented in this report.

III. OBJECTIVES

The objectives of this test were to examine the Electra-Van 1000P for suitability of those aspects of vehicle and component operating characteristics as outlined by the Department of Energy's "Performance Standards for Demonstrations."

IV. TEST VEHICLE DESCRIPTION

The 1000P is a commercial vehicle for use primarily as a delivery truck (Figures 1 and 2). The vehicle is an electrified version of a Chrysler pickup truck. The vehicle has a wheelbase of 2.9 m (9.58 ft). The 1000P has a curb weight of 2175 kg (4790 lb) and has the capacity for a 475-kg (1000-lb) payload including two people. The batteries for the 1000P are newly developed 6-volt, lead-acid type Model XP-23 rated at 162.5 Ah at a 130-min discharge rate. The batteries, made by the ESB Corp., are configured as two modules, one under the hood of the vehicle and the other in the cargo area at the rear of the vehicle (Figures 3 and 4). In the front of the vehicle are the control electronics consisting of General Electric EV-1 SCR Controller (Figure 5).

The propulsion motor is a General Electric d.c. motor, 37-hp, series-wound, rated at 2039 r/min. The 1000P has a standard Chrysler transaxle with a manual transmission, with leaf springs and piston-type shocks, disc brakes in the front and drum in the rear. The tires are Goodyear 6-ply 5.50-15 and are inflated to 289.6 kPa (42 lbf/in²). The 1000P uses a General Electric 220 Vac off-board charger with automatic turn-off and a maximum current rating of 30 A.

The 1000P pickup comes with standard equipment, such as windshield wipers, windshield washers, a heater-defroster, and a speedometer-odometer. The 1000P has a gasoline heater, ammeter, and battery state-of-charge meter. The heater/defroster is a Steward Warner BH11 gasoline heater with an 1800-Btu/h output. See Appendix A for further vehicle data.

V. TEST RESULTS

1. Verification Test. The following are the results of the verification test performed at MERADCOM during 11 October to 29 October 1979. Paragraphs are referenced to the DOE "Performance Standards for Demonstrations" criteria.

a. Acceleration: 50 km/h (31.1 mi/h) in 12.5 s.

b. Gradeability at Speed: At 25 km/h (15.5 mi/h) vehicle can traverse a 13.2-percent grade based on calculation from acceleration tests.

c. Gradeability Limit: Vehicle should start and climb forward on a 27-percent grade for at least 20 s based on drawbar pull test. Reverse gradeability calculated based on reverse-gear ratio relative to first-gear ratio indicate a 28.1-percent gradeability limit.

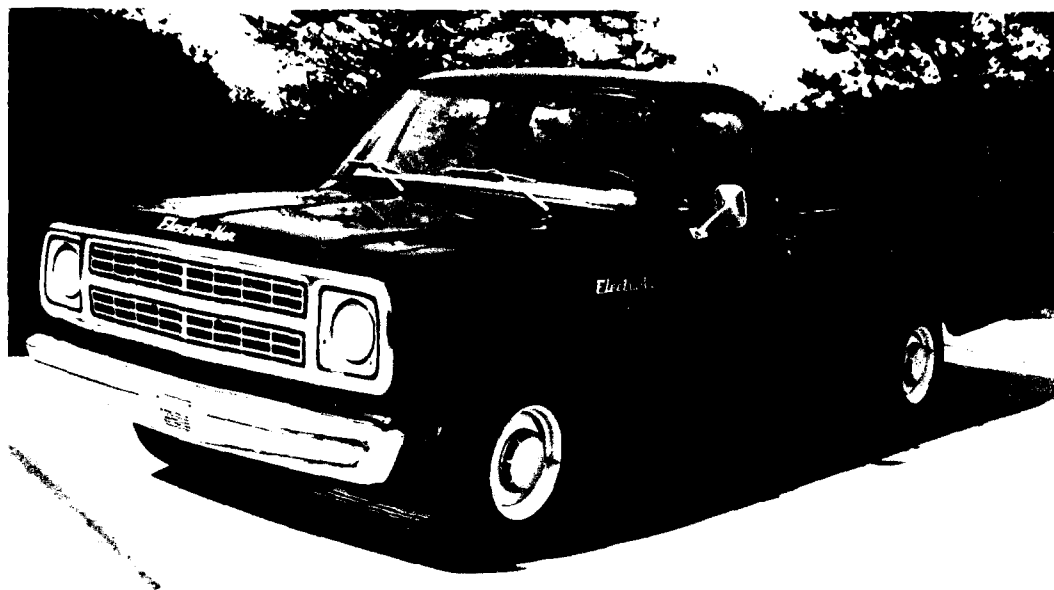


Figure 1. Front/side view of Electra-Van 1000P.

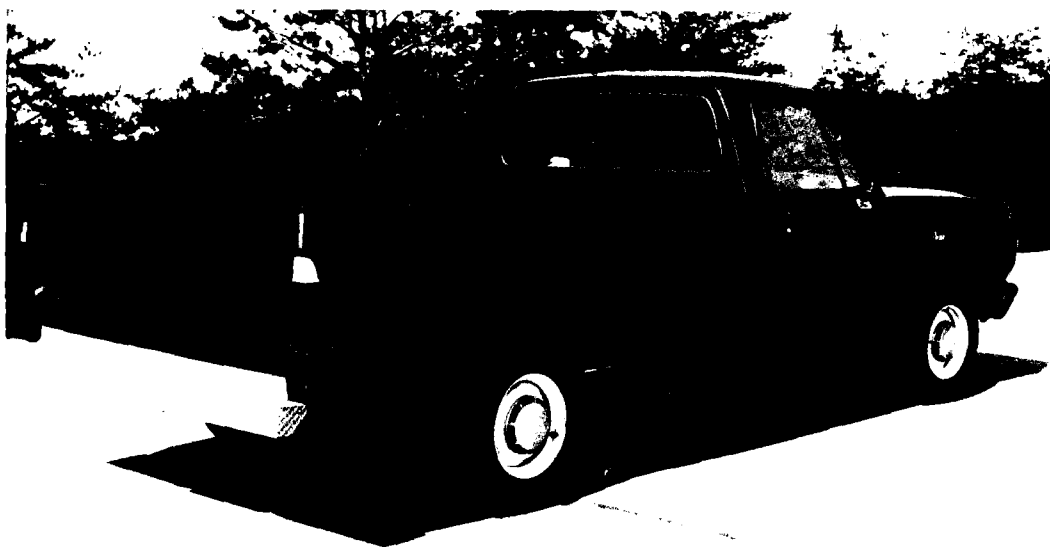


Figure 2. Rear/side view of Electra-Van 1000P.

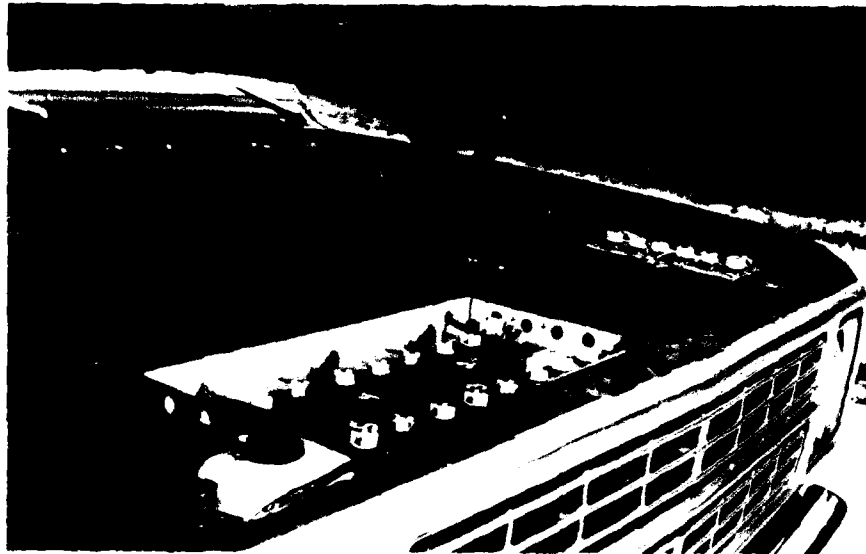


Figure 3. Front of vehicle showing traction and auxiliary batteries.

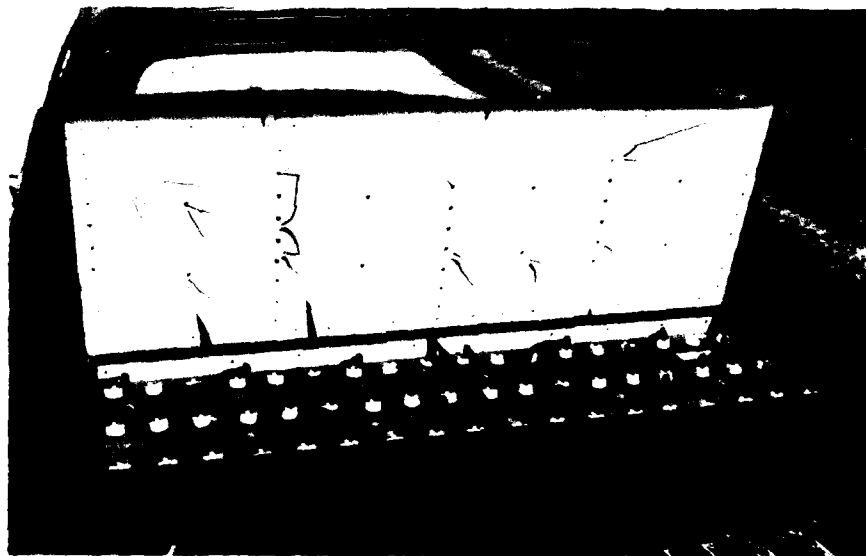


Figure 4. Cargo area showing rear traction batteries.

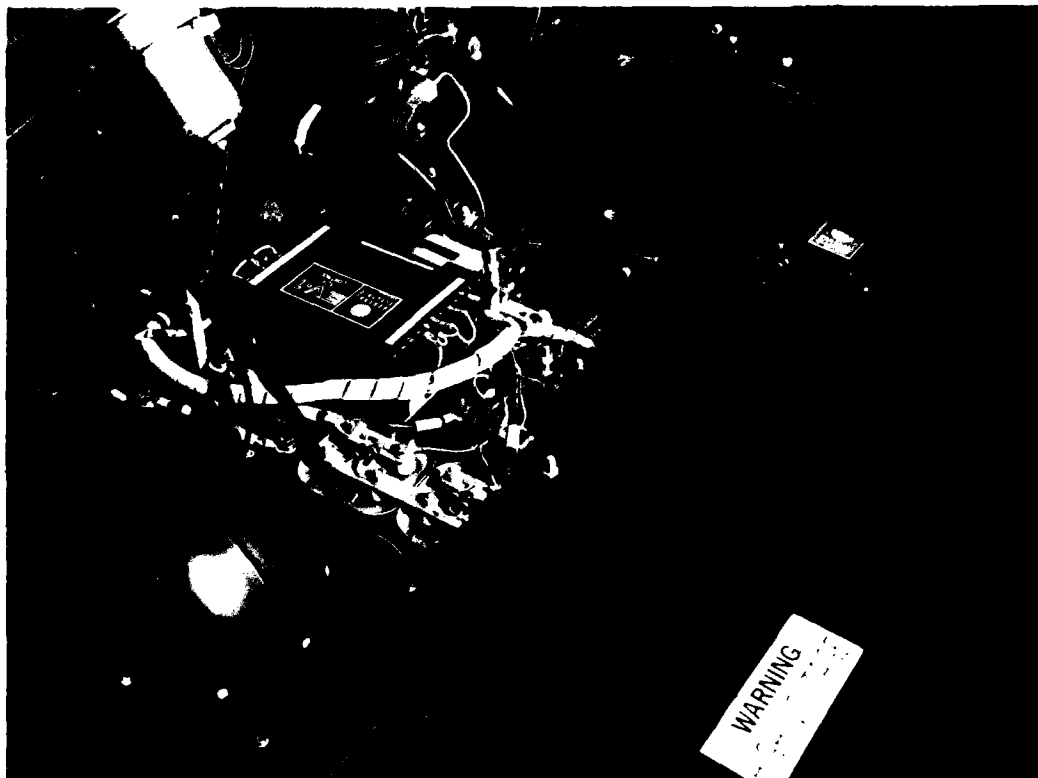


Figure 5. Controller and associated electronics.

d. Forward Speed Capability: The vehicle maintained 70 km/h (43.4 mi/h) for a minimum of 5 min on the level portion (\pm 1-percent grade) of the MERADCOM test track.

e. Range: SAE J227a cycle "B" on level (\pm 1-percent) grade 59.4 km (36.8 mi) and 169 cycles.

f. Battery Recharge Time: After an 80-percent discharge, recharged with 220 VAC (30 A maximum) off-board charger for 10 h; after recharge, vehicle operated for at least 50 km to an SAE J227a cycle "B" regime.

g. Recharge Control: Voltage comparator.

h. Energy Consumption: The only nonelectrical energy used by the vehicle is for the gasoline-fueled heater.

i. Battery:

- (1) Warranty: 12 mo.
- (2) Type: ESB-XPV 23.
- (3) Capacity: 162.5-Ah (75 A, 130 min).
- (4) Voltage: 144 V (24 modules of 6V each in series).

j. State-of-Charge Meter: The vehicle was equipped with a State-of-Charge Meter, made by Anderson Power Products, which indicates percent of battery capacity.

k. Odometer: Yes.

l. Passenger Comfort Heater: Optional.

m. Documentation: Maintenance and repair manuals were submitted. No parts list was submitted.

n. Emissions: Did not evaluate.

o. Safety: The Department of Transportation is performing these evaluations; however, MERADCOM performed the following limited checks:

- (1) Electrical Isolation: The electrical propulsion system is isolated by design.
- (2) Safety Standards 208 and 301: DOT will check compliance.
- (3) Battery Caps: Standard golf-cart industry type. Flame-barrier characteristics were not tested.
- (4) Ventilation of Battery Compartment: Each compartment is ventilated by means of a 130-ft³/min blower which draws fresh air into the compartment and forces air out.
- (5) Battery Energy Disconnection: This consisted of a manually activated, mechanically linked disconnect switch operated from the operator's normal position.
- (6) Parked Temperature Effect: Parked vehicle for an 8-h period at each of the temperatures: -25°C and 50°C. Subsequent operation revealed no apparent damage to vehicle or hazard to persons.

2. Brake Test. Braking straight-line dry and brake operability without electric power tests were performed. The Society of Automotive Engineers Recommended Practice, Electric Vehicle Test Procedure (SAE J227a) was used as a base for the test. This procedure requires that the force applied to brake control shall not be less than 66.9N (15 lb) and not more than 669N (150 lb) (FMVSS). The stopping distance requirements for the Electra-Van 1000P are:

Vehicle Speed km/h	Maximum Distance in Meters*
56.32	33.55
72.41	55.51

*NOTE: Vehicles other than passenger cars with GVW of 4540 kg (10,000 lb) or less.

The vehicle displayed the following braking characteristics:

Vehicle Speed	Distance	Force Applied
56 km/h (35 mi/h)	30.7 m (100.7 ft)	449.5N (112 lb)
72 km/h (45 mi/h)	32.16 m (106.8 ft)	637.8N (143 lb)

VI. CHRONOLOGY OF VEHICLE FAILURES AND CORRECTIVE ACTIONS

No significant failures were experienced.

APPENDIX A

VEHICLE DATA SUMMARY SHEET

1. Vehicle Manufacturer:

Electra-Van
Jet Industries, Inc.
4201 South Congress Ave.
Austin, Texas 78745

2. Vehicle Description:

Name: Electra-Van
Model: 1000P
Availability: 60 days
Price: \$12,875

3. Vehicle Weight:

Curb Wt: 2175 kg (4790 lb)
Driver Wt: 68 kg (150 lb)
Payload Wt: 475 kg (1000 lb)
Gross Wt: 2767 kg (6100 lb)

4. Vehicle Size:

Wheelbase: 292 cm (115.0 in.)
Length: 483 cm (190 in.)
Width: 202 cm (79.5 in.)

5. Auxiliaries and Options:

- No. Lights: 19
- a. Headlights
 - b. Parking Lights — Front and Rear
 - c. Side Markers Front Only
 - d. License Plate
 - e. Dome Light
 - f. Tail Lights and Signal Lights

Windshield Wipers: Yes
Windshield Washers: Yes
Defroster: Yes
Heater: Yes
Radio: No
Fuel Gage: Yes
Ammeter: Yes
Tachometer: No
Speedometer: Yes
Odometer: Yes
No. Mirrors: 3
Power Steering: Yes
Power Brakes: No
Transmission Type: 3-Speed, Manual

6. Propulsion Batteries:

Type: Lead-Acid
Manufacturer: ESB
No. of Modules: 24
No. Cells: 72
Battery Voltage: 144
Ah Capacity: 162.5
Battery Size: 26.4 cm x 18.3 cm x 28.8 cm (10.4 in. x 7.2 in. x 11.34 in.)
Battery Wt: 29.4 kg (65 lb)
Battery Age: New
Battery Rate: 75 A — 130 min

7. Auxiliary Battery:

Type: Lead-Acid
Manufacturer: ESB

8. Controller:

Type: SCR
Manufacturer: General Electric
Voltage Rating: 144
Current Rating: 450 A
Size: 27.9 cm x 40.6 cm x 17.8 cm (11 in. x 16 in. x 7 in.)
Weight: 36.3 kg (80 lb)

9. Propulsion Motor:

Type: Series
Manufacturer: General Electric
Insulation Class: H
Voltage Rating: 165 V
Current Rating: 175 A
HP Rating: 37 at 2039 r/min
Max 5 min Rating: N.A.
Size: 27.9 cm Dia, 46.4 cm lg (11 in. Dia x 18¼ in. lg)
Weight: 115.6 kg (255 lb)
Rated Speed: 2000 r/min
Max Speed: 10,000 r/min

10. Body:

Type: Pickup
Manufacturer: Chrysler Corp.
No. Doors: 2
Type: Dodge
No. Windows: 4
Type: 2 rolldown; 2 vent
No. Seats: 1
Type: Bench

11. Chassis:

Type Frame: Std. Chrysler
Manufacturer: Chrysler Corp.
Type Material: Steel
Modifications: N.A.
Type Springs: Leaf and Coil
Type Shocks: Hydraulic
Axle Type Front: Std.
Axle Type Rear: Transaxle
Axle Manufacturer: Chrysler Corporation
Drive Line Ratio: 3.2:1
Type Brakes Front: Drum
Type Brakes Rear: Drum
Regenerative Brakes: No
Tire Type: 6-ply Bias

Manufacturer: Goodyear
Size: 4L78 x 15
Pressure: 310 kPa (45 lb/in.²)
Rolling Radius: 381 mm (15 in.)

12. Battery Charger:

Type: Ferro-Transformer
Manufacturer: General Electric
On or Off Board: Off
Input Voltage: 115/230 VAC
Peak Current: 15/30 A
Recharger Time: Automatic
Automatic Turn Off: Yes

APPENDIX B

PERFORMANCE STANDARDS FOR DEMONSTRATIONS

FEDERAL REGISTER

30 MAY 1978

PART V SUBPART B

475.11 Minimum levels of performance for commercial vehicles.

The following minimum levels of performance are required with respect to any commercial vehicles purchased or leased pursuant to section 7 (c) of the Act.

(a) Acceleration. The time required to accelerate from rest to 50 km/h shall not exceed 15 s.

(b) Gradeability at speed. The grade which can be traversed up at 25 km/h shall be at least 10 percent.

(c) Gradeability limit. The grade on which the vehicle can start and climb for 20 s either backward or forward shall be no less than 20 percent.

(d) Forward speed capability. The speed which can be maintained for 5 minutes shall be 70 km/h.

(e) Range. The distance which the vehicle can be operated with vital accessories on or equivalent shall be:

(1) For an electric vehicle, at least 50 km on the SAE J227a/B cycle, and

(2) For a hybrid vehicle, at least 200 km on the SAE J227a/B cycle.

(f) Battery recharge time. The vehicle shall be capable of satisfying the range requirement of 475.11 (e) above, after being recharged for no more than 10 hours. At the start of this recharge the vehicle shall have 80 percent discharged batteries as specified by the vehicle test conditions and procedures of 475.3.

(g) Recharge control. The vehicle shall have a recharge control which is adequate to meet the requirements of energy, life, and safety as such requirements are stated by these performance standards.

(h) Energy consumption:

(1) For an electric vehicle, the maximum amount of nonelectrical energy consumed shall be that used for operation of the accessories only.

(2) For a hybrid vehicle, nonelectrical energy consumed shall not exceed 9.8 kJ/kmkg of cargo and shall also not exceed 75 percent of total energy consumed for propulsion and vital accessories, based on being fully loaded on a driving schedule of 100 km on SAE J227a/B cycle, the cargo not including the operator, and with vital accessories on.

(i) Battery life:

(1) The vehicle shall be capable of at least 75 percent of the range specified in 475.11 (e) after 12 months or 15,000 km of normal use, whichever occurs first.

(2) The vehicle shall be capable of 100 percent of the acceleration and gradeability specified in 475.11 (a), (b), and (c), for all test conditions and procedures specified by 475.3, for 12 months or 15,000 km of normal use, whichever occurs first.

(3) The batteries shall, if necessary, be repaired or replaced by the vehicle manufacturer at no cost to the user of the vehicle in order to meet requirements of (1) and (2) of 475.11 (i).

(j) State-of-charge meter. The vehicle shall have a state-of-charge meter for the propulsion battery system or other means of providing an indication of remaining range.

(k) Odometer. The vehicle shall have an odometer.

(l) Passenger comfort heater. The vehicle shall have a passenger comfort heater available as an option.

(m) Documentation. Adequate user manuals, maintenance (service) manuals, and parts lists shall be provided.

(n) Emissions. The vehicle shall comply with all applicable Federal emissions regulations for motor vehicles.

(o) Safety, crashworthiness, damageability, crash avoidance, and hazards:

(1) The vehicle shall comply with all applicable Federal regulations for motor vehicles concerning safety, crashworthiness, damageability, crash avoidance, and hazards unless a waiver or modification is obtained from the Department of Transportation.

(2) Until the Department of Transportation issues regulations which cover the same subjects, the vehicles shall also have the following performance characteristics:

(i) The electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle.

(ii) The vehicle shall be capable of undergoing the test procedure of Federal Motor Safety Standards 208 and 301 with all battery materials remaining outside the passenger compartment.

(iii) Vehicles with battery caps or battery vents shall have flame barrier provisions to inhibit battery explosions.

(iv) Ventilation shall be adequate within the battery compartment to maintain the concentration of hydrogen below 4 percent by volume during vehicle operation (including charging and maintenance).

(v) The vehicle shall have a device which provides for the positive disconnection of the battery and which is operable from the normal operator position.

(vi) The vehicle shall be capable of being parked for up to 8 hours in temperatures of -25°C to 50°C and subsequently operated at any temperature within this temperature range without damage to the vehicle or to persons.

APPENDIX C

ELECTRIC AND HYBRID VEHICLE VERIFICATION PROCEDURES

Background

DOE is required by Public Law 94-413 to issue performance standards for vehicles used in the Electric and Hybrid Vehicle (EHV) Market Demonstration. On 30 May 1978, DOE published a final rule in the Federal Register (Vol. 43, No. 104) promulgating the first Performance Standards. This rule was effective on 3 July 1978, and prescribed minimum performance standards for electric and hybrid vehicles to be purchased or leased for the first phase of a demonstration program under the Electric and Hybrid Research, and Development Act of 1976. Performance Standards are updated from time to time and the current rule was published in the Federal Register on 12 February 1980 (Vol. 45, No. 30).

Manufacturers who certify that their vehicles meet the latest requirements of the DOE Performance Standards may offer those vehicles for the DOE Market Demonstration Program. DOE reserves the right to verify, by independent test, the manufacturer's self-certification. The test procedures used for DOE performance tests are based on SAE Test Procedure J227a. Safety inspection and testing services are provided by the Department of Transportation/National Highway and Traffic Safety Administration (DOT/NHTSA) through an interagency agreement. Performance testing is performed by the US Army Mobility Equipment Research and Development Command (MERADCOM) through an interagency agreement. During verification testing vehicle component or subsystem failures will be immediately brought to the attention of the manufacturer. Repeated or multiple component or subsystem failures experienced during test are grounds for invalidating the self-certification of the vehicle for purpose of the DOE Market Demonstration Program.

Certification Process

A manufacturer can certify an existing vehicle as meeting the DOE Standards (which include applicable NHTSA safety standards by reference) at any time by submitting a letter of certification and providing the required data on the vehicle to the Department of Energy Director of Electric and Hybrid Vehicles Division or his designee.

Verification Process

Should DOE elect to verify the certification, arrangements will be made with the manufacturer for delivery of the vehicle to a DOE-specified site for testing. (Details of scheduling priorities are described in the following section.) Several basic types of tests may be involved:

- DOE-Sponsored Performance Tests by the US Army MERADCOM.
- DOE-Sponsored Safety Inspection by DOT/NHTSA.
- DOE-Sponsored Safety Compliance Testing by the Research Division of DOT/NHTSA.
- DOT/NHTSA Safety Compliance Test (Independent of DOE).

One important principle followed by DOE during testing is to allow the Facility Manager to work with manufacturers to overcome the normal problems that occur during inspection and testing. To ensure impartial treatment of manufacturers during the test sequence, limits have been set for the Test Facility Manager concerning how many vehicle component or subsystem failures can be allowed before certification is invalidated. DOE will objectively evaluate the impact of all failures during the testing phase so that vehicles are not unfairly penalized for minor and easily correctable failures. The Test Facility Manager, however, has an obligation to conduct the testing thoroughly and to adhere to a tight schedule.

Manufacturers may be notified from time to time by the Test Facility Manager of potential and actual problems. When these problems do not involve components or subsystem failures, where failure is defined as a vehicle being below the required standard, such notification would not necessarily invalidate the certification.

Test Facility Scheduling Guidelines

Vehicles will be scheduled for testing by the Test Facility Manager on a first-come, first-served basis, with certain exceptions as noted below. Scheduling is dependent upon the ability of the manufacturer to provide a vehicle for testing. The Test Facility Manager will request the manufacturer to provide a certified vehicle for testing within 60 days from the date of the request. If a vehicle is not received at the Test Facility within the 60-day period, the self-certification will be returned and the vehicle will be removed from the self-certification list.

The primary function of certification testing is to ensure that vehicles available to the Market Demonstration Program fully satisfy the applicable DOE Performance Standards. For this reason, it is necessary to establish a set of priority testing categories for vehicles selected or being considered for selection by demonstration site operators. The categories are listed below in decreasing order of priority for testing:

1. Certified vehicles which have not been verified but have been purchased by and delivered to site operators.
2. Certified vehicles purchased by but not delivered to site operators for demonstration.
3. Certified vehicles that have been modified subsequent to verification testing and have been delivered to site operators.* On request by DOE, the manufacturer will furnish DOE with technical information about each modification in sufficient detail to determine if reverification tests are needed.
4. Certified vehicles that are being considered for purchase by a site operator.
5. Certified vehicles that are available for test but are not under consideration by a site operator.

Vehicle test schedules are sensitive to the requirements of the Market Demonstration Program, and rescheduling by the Test Facility Manager may be required to meet changing needs. Vehicles delivered late or taken out of test because of operational failure may be rescheduled on a lower priority basis by the Test Facility Manager with approval of the DOE Test Manager. On-site rectification of a vehicle problem by the manufacturer within a 5-working-day period described below may avoid the necessity for rescheduling.

Vehicle Modification/Repair Guidelines

The guidelines provided in this section are for use by the Test Facility Manager. Exceptions to these guidelines require the approval of the Director of the DOE Electric and Hybrid Vehicle Division or his designee. The intent of these guidelines is to facilitate the establishment of a clear basis for validating or invalidating a manufacturer self-certification. Subsystem failures may raise questions as to the relevance of the results of the validation testing. It is also important that the test facilities not be used for development and test engineering. Vehicles that experience repeated failures of the same component or subsystems must be upgraded before verification testing can be rescheduled. Rescheduling will be contingent on the submission and acceptance of evidence, obtained

* The manufacturer is responsible for notifying the DOE Director of the Electric and Hybrid Vehicle Division or his designee of all modifications to the verified production configuration.

by the manufacturer through testing, that the cause of failure has been corrected. The Test Facility will determine when significant repairs should be and have been made.

Vehicle Modifications/Repairs On or Near the Test Facility

A. Only those modifications or repairs that can be completed within 5 working days by the manufacturer or his designee will be allowed. If the repairs cannot be completed within this period, the vehicle must be removed from the test facility unless DOE programmatic requirements dictate it is in the best interest of the Government that a waiver be granted by the Director of the Electric and Hybrid Vehicles Division or his designee.

B. All failures requiring repair, whether significant or insignificant, will be recorded by the Test Facility Manager or his designee. For all repairs the manufacturer must submit (to the Test Facility Manager) written explanation of the failure modes and the corrective action taken within 15 days after completion of corrective action. Failed components or subsystems must be replaced by an identical part except in those cases where the component or subsystem design is inadequate. In the latter case, the manufacturer may substitute a readily available component or system when the manufacturer can provide assurance of improved reliability and performance.

C. Three on-site repairs to correct a significant powertrain failure are allowed. A fourth failure will invalidate the vehicle certification, and the Facility Manager will order the vehicle to be returned to the manufacturer unless DOE programmatic requirements dictate that a waiver be granted by the Director of the Electric and Hybrid Vehicles Division or his designee.

D. Subject to overriding priority considerations, testing will be resumed as soon as repairs are completed.

Vehicle Returned to the Manufacturer Because of Failure in Test

A. A letter invalidating the certification will be issued to the manufacturer and DOE will notify site operators of the invalidation. A report including the vehicle failures will be provided by DOE to members of the public requesting such a report. Vehicles that are part of the Market Demonstration Program (based on the manufacturer's self-certification) which fail the verification tests will have their certification invalidated until successful correction of the defects is completed. Future funding to site operators for the invalidated vehicle model will be suspended until corrections are completed.

B. A one-time voluntary withdrawal of a vehicle from test by a manufacturer to correct problems is allowed for a period not to exceed 60 days. The vehicle will be

rescheduled for testing based on priorities at the time of resubmittal. No action will be taken to invalidate the certification during the voluntary withdrawal period unless there is a clear case of user safety involved or the manufacturer fails to offer the vehicle for test after 60 days.

C. Before a vehicle can be resubmitted for testing, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division, or his designee, appropriate evidence that modifications and/or repairs have been made. The manufacturer must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards.

D. Repaired vehicles returned by the manufacturer may be required to undergo the complete series of verification tests regardless of the portion of testing completed prior to invalidation of certification. The Test Facility Manager with the approval of DOE, will determine the necessity for such retesting.

Grounds for Invalidating Certification

1. A vehicle will be returned to the manufacturer after four significant powertrain failures or a single powertrain failure that cannot be corrected, and its certification will be invalidated.

2. A vehicle that fails to meet applicable DOE Performance Standards will have its certification invalidated. (The standards include documentation and warranty provisions.)

3. A vehicle that fails to comply with applicable DOT/NHTSA Safety Regulations will have its certification invalidated.

4. If a manufacturer fails to commit to and follow a reasonable schedule (defined in the following section) to provide a vehicle for testing when requested by DOE, the vehicle will have its certification invalidated.

Summary of Responsibility of Manufacturers

Manufacturers must self-certify their production vehicles to participate in the DOE Market Demonstration Program. They must also commit to a reasonable schedule to provide a vehicle for verification testing upon request from the DOE designated Test Facility Manager. If this delivery cannot be made within 60 days after receipt of such a request, the self-certification letter will be returned and the vehicle will be removed from the self-certified list.

Manufacturers must provide required and necessary information to document the vehicle configuration:

- Vehicle Summary Data Sheets.
- Operator's Manual, and
- Service and Maintenance Manual including a parts list.

This information may be in draft form, but it must be complete enough to be useful should any mechanical or electrical difficulty develop in the vehicle.

The manufacturer will notify the Director of the Electric and Hybrid Vehicles Division or his designee of all modifications to previously verified production configurations within 30 days of the sale of such modified vehicles to DOE site operators. If it is requested, the manufacturer shall furnish the DOE Test Manager with technical information about each modification in sufficient detail to determine if reverification tests are needed.

For vehicles receiving an invalidation of certification, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division appropriate evidence that modifications and/or repairs have been made and must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards prior to resubmittal of the vehicle for test. Following successful verification testing, vehicles already in DOE site operator fleets must be modified and/or repaired in the same manner as the vehicle successfully tested. A modification and/or repair schedule acceptable to the Director of the Electric and Hybrid Vehicles Division must be developed and followed by the manufacturer as a condition for validation of the manufacturers certification.

DOE Notification Documentation

DOE will notify manufacturers of actions taken during the verification testing process, including but not limited to:

- Receipt of self-certification.
- Notification of vehicle failure.
- Validation or invalidation of certification.
- Final Test Report.

DISTRIBUTION FOR MERADCOM REPORT 2311

No. Copies	Addressee	No. Copies	Addressee
	Department of Defense		
1	Director, Technical Information Defense Advanced Research Projects Agency 1400 Wilson Blvd Arlington, VA 22209	1	Commander US Army Troop Support and Aviation Materiel Readiness Command ATTN: DRSTS-MES (1) 4300 Goodfellow Blvd St Louis, MO 63120
1	Director Defense Nuclear Agency ATTN: TITL Washington, DC 20305	1	Director Petrol & Fld Svc Dept US Army Quartermaster School Fort Lee, VA 23801
1	Defense Technical Information Ctr Cameron Station Alexandria, VA 22314	1	Commander US Army Electronics Research and Development Command Technical Library Division ATTN: DELSD-L Fort Monmouth, NJ 07703
	Department of the Army		
1	Commander, HQ TRADOC ATTN: ATEN-ME Fort Monroe, VA 23651	1	HQ, 193D Infantry Brigade (Pan) ATTN: AFZU-FE APO Miami 34004
1	Technical Library Chemical Systems Laboratory Aberdeen Proving Ground, MD 21010	1	Special Forces Detachment, Europe ATTN: PBO APO New York 09050
1	Commander US Army Aberdeen Proving Ground ATTN: STEAP-MT-U (GE Branch) Aberdeen Proving Ground, MD 21005	1	Commander Rock Island Arsenal ATTN: SARRI-LPL Rock Island, IL 61201
1	Director US Army Materiel Systems Analysis Agency ATTN: DRXSY-CM Aberdeen Proving Ground, MD 21005	1	HQDA ODCSLOG DALO-TSE Room 1E588 Pentagon, Washington, DC 20310
1	Director US Army Materiel Systems Analysis Agency ATTN: DRXSY-MP Aberdeen Proving Ground, MD 21005		

No. Copies	Addressee	No. Copies	Addressee
1	Commander Headquarters, 39th Engineer Battalion (Cbt) Fort Devens, MA 01433	1	Chief, Ctrmine Lab, DRDME-N Chief, Engy & Wtr Res Lab, DRDME-G Chief, Elec Pwr Lab, DRDME-E Chief, Camo & Topo Lab, DRDME-R Chief, Mar & Br Lab, DRDME-M Chief, Mech & Constr Eqpt Lab, DRDME-H Chief, Ctr Intrus Lab, DRDME-X Chief, Matl Tech Lab, DRDME-V Director, Product A&T Directorate, DRDME-T CIRCULATE
1	Commander and Director USA FESA ATTN: FESA-TS Fort Belvoir, VA 22060		
1	Director US Army TRADOC Systems Analysis Activity ATTN: ATAA-SL (Tech Lib) White Sands Missile Range, NM 88002		
1	HQ, USAEUR & Seventh Army Deputy Chief of Staff, Engineer ATTN: AEAEN-MT-P APO New York 09403	100	Electrochemical Div, DRDME-EC
1	HQ, USAEUR & Seventh Army Deputy Chief of Staff, Operations ATTN: AEAGC-FMD APO New York, 09403	3	Tech Reports Ofc, DRDME-WP
2	District Engineer ATTN: SWFED-MF FWD Corps of Engineers P.O. 17300 Fort Worth, TX 76102	3	Security Ofc (for liaison officers), DRDME-S
		2	Tech Library, DRDME-WC
		1	Programs & Anal Dir, DRDME-U
		1	Pub Affairs Ofc, DRDME-I
		1	Ofc of Chief Counsel, DRDME-L
	MERADCOM		Department of the Navy
1	Commander, DRDME-Z Technical Director, DRDME-ZT Assoc Tech Dir/R&D, DRDME-ZN Assoc Tech Dir/Engng & Acq, DRDME-ZE Spec Asst/Matl Asmt, DRDME-ZG Spec Asst/Scs & Tech, DRDME-ZK CIRCULATE	2	Commander, Maval Facilities Engineering Command Department of the Navy ATTN: Code 032-B 062 200 Stovall St Alexandria, VA 22332
		1	US Naval Oceanographic Office Navy Library/NSTL Station Bay St Louis, MD 39522

No. Copies	Addressee	No. Copies	Addressee
1	Library (Code L08A) Civil Engineering Laboratory Naval Construction Battalion Center Port Hueneme, CA 93043	3	Batronic Truck Corp Third & Walnut St Boyertown, PA 14512
1	Naval Training Equipment Center ATTN: Technical Library Orlando, FL 32813		Department of Energy
3	Naval Weapons Center (Code 2605) China Lake, CA 93555	200	ATTN: Walter J. Dippold 1000 Independence Ave Mail Stop 5H044 Room 5H063 Forrestal Bldg Washington, DC 20585
	Department of the Air Force	1	Albert Cook International Lead Zinc Research Organization, Inc 292 Madison Ave New York, NY 10017
1	HQ USAF/RDPT ATTN: Mr. Allan Eaffy Washington, DC 20330	1	Bernie Wachter DAO Corp 2101 L Street NW Washington, DC 20037
1	Mr. William J. Engle Chief, Utilities Branch HQ USAF/PREEU Washington, DC 20332	1	C. Joseph Venuto 3043 Walton Road Plymouth Meeting, PA 19462
1	US Air Force HQ Air Force Engineering & Services Ctr Technical Library FL 7050 Tyndall AFB, FL 32403	1	J. Hampton Barnett Energy Demonstration & Technology 109 United Bank Building Chattanooga, TN 37401
1	Department of Transportation Library, FOB 10A, M494-6 800 Independence Ave., SW Washington, DC 20591	1	Department of Transportation Library, FOB 10A, TAD-494.6 800 Independence Ave, SW Washington, DC 20591
1	Mr. Carl Anderson Energy Technology Demonstration SM-ALC/XAE McClellan AFB, CA 95652	1	A. D. Little ATTN: Brad Underhill 15 Acorn Park Cambridge, MA 02140
	Others		
1	Professor Raymond R. Fox School of Engineering and Applied Science George Washington University Washington, DC 20052		

No. Copies	Addressee	No. Copies	Addressee
1	Advanced Ground Systems Eng ATTN: Dr. George Gelb 3270 E. 70th Street Long Beach, CA 90805	1	Department of Transportation Transportation Systems Center ATTN: Dr. Norman Rosenberg Cambridge, MA 02142
1	Airesearch Manufacturing Co ATTN: Bob Rowlett Program Manager 2525 W. 190th Street Torrance, CA 90509		Electric Power Research Institute
		1	ATTN: Dr. Fritz R. Kalhammer
		1	ATTN: Ralph Ferraro 3412 Hillview Avenue P.O. Box 10412 Palo Alto, CA 94304
1	Argonne National Labs ATTN: Al Chilenskas 9700 South Cass Avenue Argonne, IL 60439		
		1	ESB, Inc. 5 Penn Center Plaza Philadelphia, PA 19103
1	Billings Energy Corporation ATTN: Mr. Hadden P.O. Box 555 Provo, UT 84601		
		1	General Electric Corporate Research & Development ATTN: Gene Rowland Program Manager P.O. Box 8 Schenectady, NY 12301
1	Booz, Allen & Hamilton Inc <i>John F. Wing</i> Transportation Consulting Div 4330 East West Highway Bethesda, MD 20014		
		1	General Research Corporation ATTN: John Brennand 5383 Hollister Avenue Santa Barbara, CA 93105
1	Borisoff Engineering Co 7726 Burnet Ave Van Nuy, CA 91405		
		1	General Services Administration Federal Supply Service ATTN: Mel Globeman Washington, DC 20406
1	Cooper Development Association ATTN: Donald K. Miner, Manager 430 N. Woodward Ave Birmingham, MI 48011		
		1	General Services Administration Federal Supply Service ATTN: R. L. Ullrich Washington, DC 20406
1	Cornell University Joe Rosson, Associate Director School of Engineering Phillips Hall Ithaca, NY 14853		
1	Department of Industry, Trade, & Commerce Fred Johnson, Special Vehicle Div Transportation Industries Branch Ottawa, Canada, KIA085		

No. Copies	Addressee	No. Copies	Addressee
2	Jet Propulsion Laboratory ATTN: T. Barber 4800 Oak Grove Drive Pasadena, CA 91103	1	United States Postal Service ATTN: Donn Crane, Director Office of Fleet Mgmt Delivery Services, Dept Washington, DC 20260
1	Los Alamos Scientific Labs Byron McCormick P.O. Box 1663 Los Alamos, New Mexico 87545	3	Jet Industries, Inc 2327 East Ben White Blvd Austin, TX 78741
1	NASA-Lewis Research Center ATTN: J.S. Fordyce MS: 309-1 21000 Brookpark Road Cleveland, OH 44135	1	United States Postal Service Research & Development Lab ATTN: Lewis J. Gerlach Program Manager 11711 Park Lawn Drive Rockville, MD 20852
2	NASA-Lewis Research Center ATTN: H. J. Schwartz MS: 500-215 21000 Brookpark Road Cleveland, OH 44135	1	United States Postal Service ATTN: Thomas W. Martin, manager Vehicle Services Branch Western Region San Bruno, CA 94099
1	Petro-Electric Motors, Ltd ATTN: Victor Wouk, Consultant 342 Madison Avenue, Suite 831 New York, NY 10017	1	University of California Jack Bolger Lawrence Berkeley Labs Berkeley, CA 94720
1	Purdue University IIES A.A. Potter Engineering Center ATTN: Dr. R. E. Goodson W. Lafayette, IN 47907	1	Westinghouse R&D Center ATTN: G. Frank Pittman, Jr. 1310 Beulah Road Pittsburgh, PA 15235
1	Society of Automotive Engineers, Inc. William Toth, Staff Engineer 400 Commonwealth Warrendal, PA 15096	1	Marjorie L. McClanahan Chemical Process Unit Materials Technology Aeronutronic Division Ford Aerospace & Communications Corporation Ford Road Newport Beach, CA 92663
1	United States Postal Service ATTN: Dick Bowman Office of Fleet Mgmt Delivery Services Dept Washington, DC 20260		

No. Copies Addressee

- 1 Clinton Christianson
 Argonne National Laboratory
 9700 South Lass Avenue
 Argonne, IL 60439
- 1 F. J. Liles
 705 Buffalo Drive
 Arlington, TX 76013
- 1 C. Grandy
 Union Electric Co.
 P.O. Box 149
 St. Louis, MO 63166
- 1 E. Mortek
 Johnson Control Inc.
 Globe Battery Division
 5757 N. Green Bay Ave.
 Milwaukee, WI 53201

